



SOLAR AND WIND GENERATOR FOR STREET LIGHT APPLICATION WITH SOLAR TRACKING

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Abstract: The main objective of this project is “Solar and Wind Generator for Street Light Application with Solar Tracking”. The Solar Tracking – Vertical Axis Wind Turbine System is not only cheap and efficient, but also eco-friendly. This turbine generate electricity using both solar and wind energy. So, for uninterrupted electricity generation, we have two powerful and inexhaustible sources. The system has two basic Components- one for electricity generation through solar energy and another for wind generation. Our project focuses on the use of air on highway divider with the help vertical axis wind turbine. When the vehicles passed on the highway, it produces a considerable amount of air due to its speed. The blade of the vertical axis wind turbine strikes tangentially and makes the turbine spin in just one direction. The solar system is used to enhance the overall efficiency of solar panel by keeping them aligned along with the sun position, solar tracking system is used nowadays. The electrical output of the vertical axis turbine and the solar system is stored in battery. This accumulated energy that can be used further for street use, lighting, toll gates etc.

Keywords - Hybrid energy system, Highway medium, Solar tracking, vertical axis wind turbine, Wind energy.

I. INTRODUCTION

For our day to day life, electricity is most needed. There are two methods of producing electricity, either by conventional energy resources or by non-conventional energy resources. Electrical energy demand increases in day by day so to fulfill demand we have to generate electrical energy. The electrical energy of a day is now created. Centered on traditional energy sources such as coal, diesel, nuclear, etc. The primary limitation of these sources is it creates and takes care of waste such as ash in coal power plants, radioactive waste in nuclear power plants.

Waste is very expensive and it harms nature as well. Nuclear waste is therefore very dangerous to mankind. The conventional resources are exhausting day by day. It will soon disappear entirely from the planet, so we have to find some way to produce electricity. The new source should be pollution free and economical. Healthy alternative energy options for traditional energy resources should be non-conventional energy resources. There are limitations of tidal energy, such that it can only be applied on seashores. Geothermal energy, though to extract heat from earth, very larger phase is required. In any case, solar and wind are readily accessible. Non-conventional energy options such as solar and wind can be a strong alternative source of energy.

Use two energy resources so that any one of source fails the power and input will continue to be generated by other sources. We can use both sources together in good weather conditions.^[1]

II. METHODOLOGY

2.1 Block Diagram

The block diagram for the project is shown below:

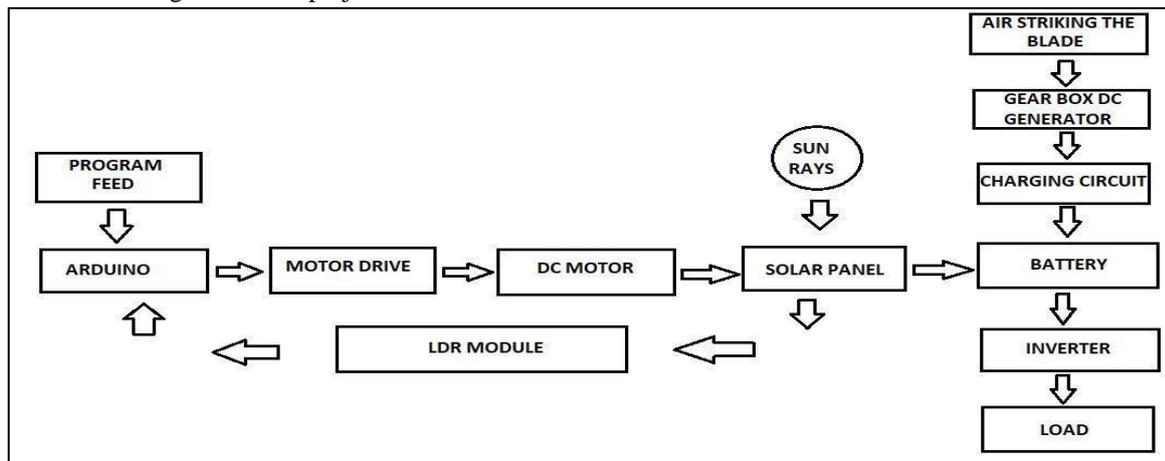


Figure 1: Block Diagram of Hybrid Model

2.2 Working Principle

In this project, we use two non-conventional energy sources one is solar generation with solar tracking and other is wind generation. The operation of this is divided in two parts 1. Solar power generation. Wind power generation.

2.2.1 Solar Power Generation

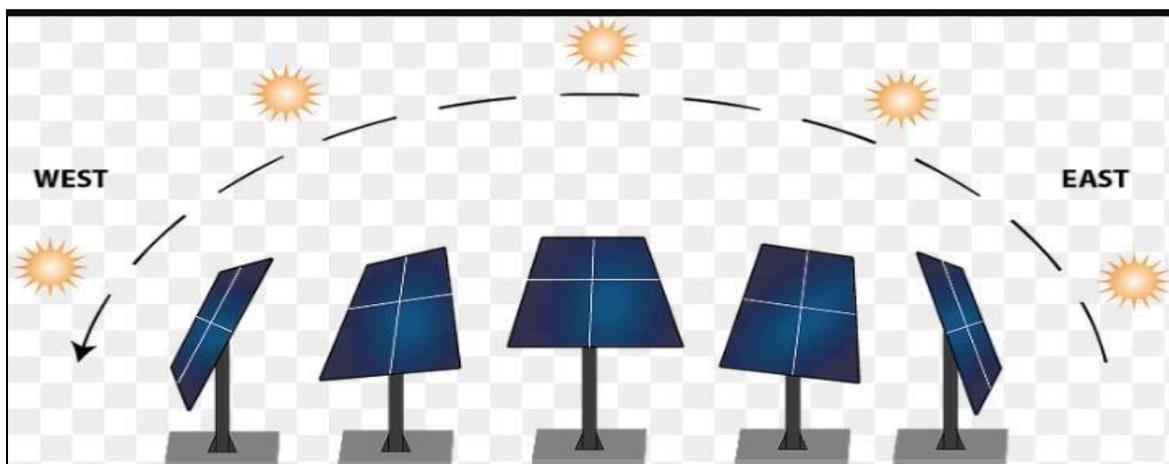


Figure 2: Solar power generation^[2]

When the solar track direction of the sun and angle, then they send back the signals to the LED module. LED send command to Arduino. The program is already fixed in Arduino, which will rotate the DC motor as per requirement such that it receives maximum sunshine. The movement of the DC motor during alignment results in generation of electricity due to the movement of shaft. As the motor rotate the solar panel which is connected to the DC motor is always comes perpendicular to the sun so we get maximum amount of energy generation.

Solar photovoltaic panels are made from photovoltaic cells. They convert sunlight into electricity. The cells are made of semi- conductive material and it can conduct electricity while maintaining the electrical imbalance needed to create electric field. ^[3]When sunlight strikes the semiconductor in the solar PV cells then the energy from the light, in the form of photons gets absorbed, knocking loose a number of electrons to flow in a certain direction towards the conductive metal plate that line cell. This flow known as electric current. As the solar panel generates an electric current, the energy flows through a wire to the battery. While solar panel generates direct current electricity so this electricity is store in battery and then supply to the load as per requirement.^[4]

2.2.2 Wind Power Generation



Figure 3: Wind power generation^[5]

The wind generation unit consists of Vertical axis wind turbine, having blades across its set up. When the vehicles passed on the highway it produces a considerable amount of air due to its speed. This air tangentially strikes on the blade of the vertical axis wind turbine and its make a rotation of the turbine in only one direction. The rotations of blades generate electricity.

Wind turbine moved wind energy converted in electricity by using aerodynamic force, which we get from the rotate blades so that air pressure on one side of the rotor blade gets decrease. The difference in air pressure across the two sides of the rotor blade creates both lift as well as drag. The rotor connected to the generator moved in both directions directly (if it is a direct drive turbine) or through the shaft and a series gears (a gearbox) that speed up the rotation of turbine. For this project, we connect rotor to generator through the shaft and a series gear box. Translation That of the aerodynamic force creates electricity.^[6]

The electricity generated by wind turbine is in the form of AC so we convert this alternating current (AC) into direct current (DC) and store in the battery. Battery is connected to inverter to convert direct current into alternating current as per load requirement. The combination of solar power and wind power coming from solar tracking and Vertical axis wind turbine are store in battery. Battery is connected to inverter to convert DC power into AC power as per load requirement.

2.2.3 Hybrid Power Generation



Figure 4: Hybrid power generation^[7]

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The combination of solar power and wind power coming from solar tracking and Vertical axis wind turbine are store in battery. Battery is connected to inverter to convert DC power into AC power as per load requirement. ^[8]Solar panel converts light energy into electrical energy by using photo voltaic cells. That generated energy is in the direct current. The energy generated by vertical axis wind turbine. This kind of energy is in the form of alternating current (AC) so to convert this AC energy into DC we use inverter. Inverter converts AC power drawn from vertical axis wind turbine to the DC power. The combination of both energy i.e. DC energy from solar power generation and AC to DC converted DC energy from vertical axis wind turbine are store in battery. At night time sun is not available so energy which is store in battery is use for street light. But connecting inverter to battery we can use this energy for other applications also as per load requirements. ^[9]

III. COMPONENTS REQUIRED

Table 1- Components required

SR.NO	MECHANICAL BODY	RATINGS
1	Blades	2 foot (30cm)
2	Gear box Dc Generator	21V & 3A
3	Solar Panel	12V & 10W
4	DC Motor	12V & 2500RPM
5	Led Panel	12V&3A
6	Battery	12V&7A
7	Inverter	12V&200W
8	Arduino Nano	5V
9	Motor Driver	16pin IC

IV. CONCLUSION

Solar tracking system can collect maximum energy than a fixed panel system collects and high efficiency is achieved through this tracker. This is an important solar energy collection monitoring device. By using Hybrid energy system in which combination of two energy resources i.e. Solar and Wind energy so we can increase efficiency and give uninterrupted power. Hence a complete hybrid system is quite beneficial to society due to its minimum cost and favorable electricity generation. It can easily install at any place. Also due to presence of two sources for power generation, it stands out to be very sustainable method. The hybrid power generation system uses the technology of solar tracking. This is done in order to ensure continuous irradiance and constant power generation throughout the day.^[10]

Portable, it can be easily transported from one place to other. Renewable source of energy like solar and wind is use which is easily available in nature. By using hybrid system it becomes more reliable. Fuels like diesel, coal are not required so cost is reduced. Clean and not produce any gases. By using solar tracking maximum energy can be generate so efficiency get increase.

Dust on the road side can affect the efficiency of solar panel so frequent cleaning of solar panel is required and it also affects on the turbine blades. Security chances are very less on the roadside.



Figure 5: Half Model of Solar Tracking and Wind Turbine

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